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Scr. No. 10/518,563

REMARKS

Claims 1-12 are now in this application. Claims 1-3 and 5 are rejected. Claim 5 is objected to. New claims 8-12 are added. Claims 1-6 are amended herein to clarify the invention. Claims 4, and 6-7 are indicated as withdrawn by the Examiner. Applicant does not concede that the restriction set forth is proper and retains right to petition against said restriction.

CLAIM OBJECTIONS

Claim 5 is objected to by the Examiner for reciting "the pinion shaft side" and "the tandem type." Claim 5 is amended to introduce "a pinion shaft side" and "a tandem type." Accordingly, withdrawal of all objections to claim 5 is respectfully requested.

CLAIM REJECTIONS UNDER 35 U.S.C. §103(a)

Claims 1, 3 and 5 are rejected as obvious over the Jacob Werner (DE19839481) reference (hereinafter "the Werner reference") in view of the Yasuto (JP63167116) reference under 35 U.S.C. §103(a). The applicant herein respectfully traverses this rejection. For a rejection under 35 U.S.C. §103(a) to be sustained, the differences between the features of the combined references and the present invention must be obvious to one skilled in the art.

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Claim 1 is now amended to positively recite the preload applied to the angular ball bearing. As discussed in the specification, an objective of the present invention is to reduce the running torque of the apparatus to thereby provide for improved economy in fuel consumption. Specification page 7. The angular contact ball bearings provide less frictional resistance than tapered roller bearings. However, the contact of the balls produces higher contact pressure. In order to reduce this characteristic, the present invention reduces the radius of curvatures R_i and R_o with respect to the ball diameter B_d . The reduction is provided for in the claims by the required relationship that:

$$R_i < R_o$$

$$0.502 \times B_d \leq R_i \leq 0.512 \times B_d, \text{ and}$$

$$0.510 \times B_d \leq R_o \leq 0.520 \times B_d.$$

The structure increases the contact surface area of the balls on the inner and outer rings and thereby reduces the surface pressure which reduces wear and impression marks on the rings. While the primary Werner reference utilizes angular contact bearings it is silent concerning relationship of the radius of curvatures R_i and R_o with respect to the ball diameter B_d . By use of the angular contact bearing with the claimed radii and the preload, the presently claimed invention provides reduced running torque and also reduced axial displacement.

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In view of the above deficiency of the Werner reference, the Examiner turns to the Yasuto reference. It will first be noted that the Yasuto reference does not teach an angular contact ball bearing. Instead, the Yasuto reference is directed to a radial ball bearing configured for carrying radial loads, hence lacking the angular contact arrangement of the claims. Furthermore, the Yasuto reference does not teach the claimed ranges. Yasuto teaches an inner ring curvature of 50.1 to 51% of ball diameter and an outer ring curvature of 50.1 to 52% of ball diameter. Additionally, an axial preload to the bearing is not taught as it is not of the angular type and not suited for thrust loads.

The bearing of the Yasuto reference is disclosed to have inner and outer curvature radii which mostly overlap, and hence do not specifically direct one to having an outer radius greater than the inner radius yet within the claimed radii ranges. The Yasuto reference does not mention the incentive to lower the contact pressure on the rings and does not suggest that radii ranges of the radial contact bearing would be applicable to the claimed angular contact bearing. Indeed, the Examiner has not set forth reasoning which would lead one skilled in the art to believe the radii of the radial bearing in the Yasuto would be applicable to the angular contact bearing of the claimed invention.

Thus, it is respectfully submitted that the rejected claims 1, 3 and 4 are not obvious in view of the cited references for the reasons stated above.

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Reconsideration of the rejections of claims 1, 3 and 4 and their allowance are respectfully requested.

Claim 2 is rejected as obvious over the Jacob Werner (DE19839481) reference (hereinafter "the Werner reference") in view of the Yasuto (JP63167116) reference and further in view of the Eklund reference under 35 U.S.C. §103(a). The applicant herein respectfully traverses this rejection.

Claim 2 further recites that the contact angle θ between the ball and the inner and outer ring raceways in the rolling bearing on the companion flange side satisfies $30^\circ < \theta \leq 45^\circ$. This limitation is in combination with the radii limitation of claim 1 discussed above. The Examiner cites the Eklund reference for teaching an angular contact of 36° and 37.5° and believes that merely because this falls within the claimed range of claim 2, the combination is obvious. Applicant respectfully disagrees.

The Eklund reference does not provide a teaching that would suggest to one skilled in the art to use the contact angles recited therein with the claimed radii of curvatures of the present invention. The Eklund reference seeks to provide a combination thrust and radial ball bearing. However, it does this by using a variable radius for the races as shown in Figs. 2 and 3. It will be noted that at the contact angles noted by the Examiner, the curvature of the races is .581R and .540R which is outside the radii of the present claim 2. From this, one skilled in

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the art would surmise that the larger contact angle necessitates larger radii than those of the claims. Thus, it cannot be said that the Eklund reference would render obvious the claimed combination of contact angles and radii because it teaches a totally different combination. Merely picking and choosing dimensions from different references does not make a case of obviousness where the references provide one skilled in the art with no inkling that a successful product will result from the combined dimensions. Additionally, the Examiner has provided no evidence of other knowledge in the art which would lead to the combination. Indeed, it would go against the teaching the Eklund reference to reduce the radii to the claimed ranges.

Thus, it is respectfully submitted that the rejected claim is not obvious in view of the cited references for the reasons stated above. Reconsideration of the rejection of the claim 2 and its allowance are respectfully requested.

NEW CLAIMS

New claims 8-12 recite that the radius of curvature R_o is larger than the radius of curvature R_i by about 1% of the ball diameter B_d . This relationship is disclosed in the specification at page 7 and is not taught by the applied references. Furthermore, there is no suggestion that the radius of curvature R_o be larger than

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the radius of curvature R_i by about 1% of the ball diameter B_d for the ranges of radii presented in claim 1.

NO FEE DUE

It is believed that no fees are due. If there is any fee due the USPTO is hereby authorized to charge any fee(s) to Deposit Account No. 10-1250.

In light of the foregoing, the application is now believed to be in proper form for allowance of all claims and notice to that effect is earnestly solicited.

Respectfully submitted,
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